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(54) Containers of electrically insulating material

(57) A container 11 of electrically insulating material, eg moulded from a plastics material such as polyethylene, has a necked orifice 16 through which the container may be filled or emptied. An electrically conductive coating 15 extends around the orifice, and preferably along one side of the container and around the base. By standing the container on a conductive surface, the build-up of static electricity during filling is prevented, by attaching an earth wire to the coating, static discharges may be prevented during emptying by tipping. The coating may extend into the orifice and over the inner surface of the container. The coating may be a pre-formed metallized plastics film or metal foil bonded to the container surface, a metal oxide coating, a metal or graphite loaded paint, a metal alloy such as zinc hot melt sprayed onto the container. An earthing lead can be clipped to bead 14.

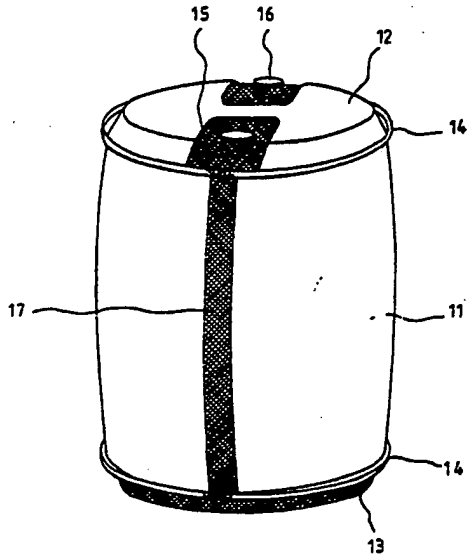

Fig.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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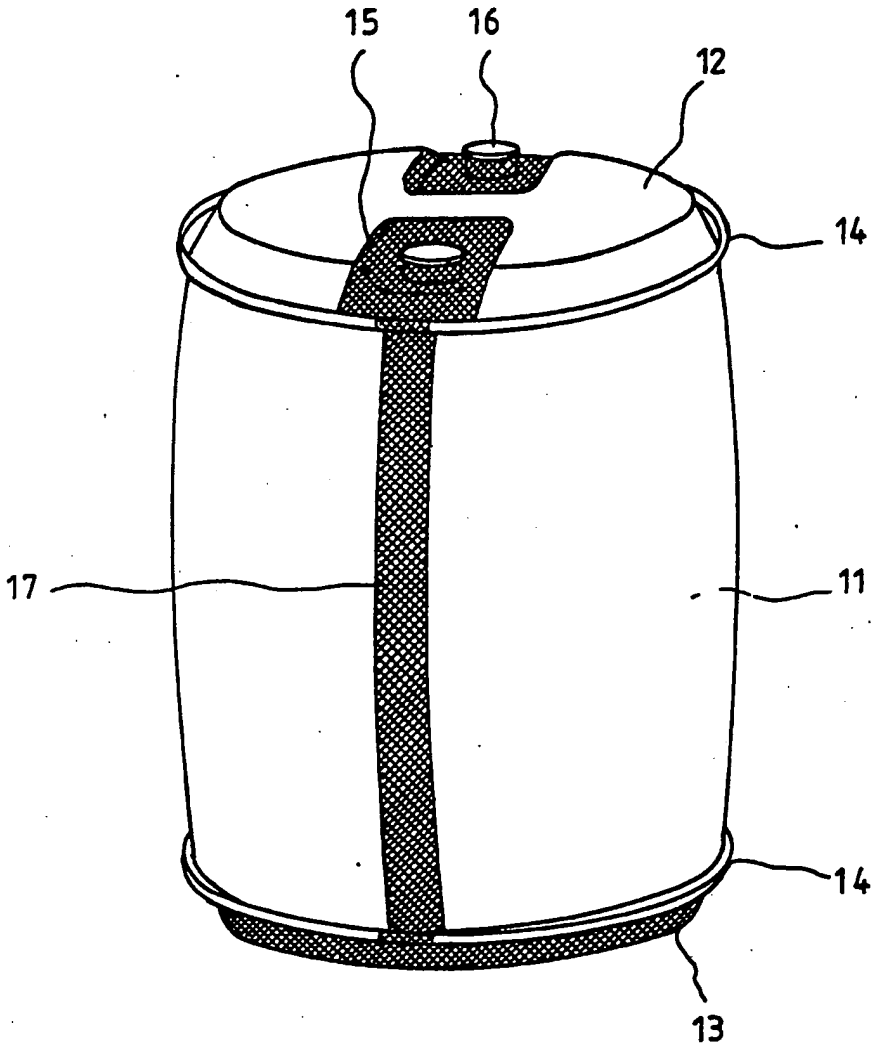

Fig.1

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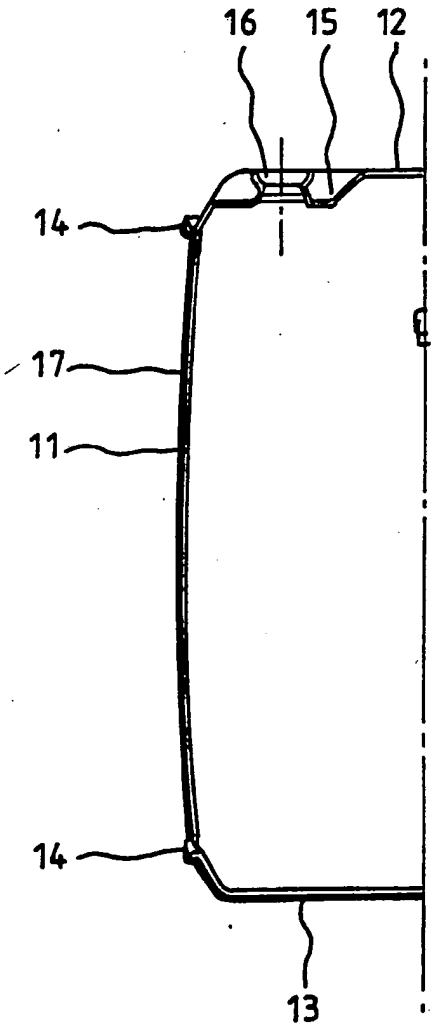

Fig. 2

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CONTAINERS

This invention concerns containers, and relates in particular to drum-like containers made of an electrically-insulating material and intended to hold flammable products.

For many years flammable liquids such as oil-based products (such as petrol and paraffin) and organic solvents (such as alcohol, acetone, ethyl acetate, benzene and toluene) have been transported around the world in steel containers, specifically drums of anywhere between 25 and 250 litre capacity. As a material for making such drums, steel has several good points, but it also has a number of bad ones - for instance, its poor corrosion resistance, and the way it is too easily dented and deformed. Much effort, therefore, has recently gone into making similar containers from a plastics material that does not suffer London. in the same way. Indeed, following the success of, in particular, high density polyethylene drums - for example, the well-known L-ring drum available from Harcostar Ltd and Bowater - serious attempts have been made to develop a comparable plastics drum for flammable liquids such as those mentioned above.

There is, however, a problem, and it is one that is familiar to those experienced in the handling of organic liquids such as petrol, jet fuel and diesel oil. Unfortunately, almost all these liquids are excellent

electrical insulators and dielectrics, so that as they are handled - such as by being poured into or out of a drum, or even by being agitated within a drum - the friction and general turbulence involved can generate a substantial static charge (the effect is known as "tribocharging") both in the liquid itself and, if made of an insulating material, in the container. This charge can be very slow to dissipate, and there is a significant possibility that at some stage charge on the liquid or on the container may neutralise itself in a manner involving a spark jumping to some convenient earth - and if at the time the ambient atmosphere is loaded with the flammable liquid in vapour form, a fire, or possibly an explosion (if the proportion of vapour in the air is substantially in the stochiometric ratio), may be the consequence.

This type of problem also occurs even when handling flammable, insulating liquids in conductive steel drums, for despite the conductive nature of the steel it is not impossible for the drum body to store static charge, especially if no leakage path to earth is available. Accordingly, it is now common practice in this field specifically to earth all the containers, pipeware and so on involved in the transfer of liquid, usually simply by clipping thereto an earthed lead. In this way, the charge build-up may be minimized, so as to minimise the risk of a spark being generated.

For containers made of an insulating material,

though, it is rather more difficult to provide the required leakage path. There is at present no easy and obvious way to collect whatever charge there may be on the container body, and much effort has been expended on the problem, without up to now finding any solution. However, the invention proposes one possible answer which, despite its apparent simplicity and perhaps even its obviousness with hindsight, appears to deal with the difficulty in a cheap but highly effective way. More specifically, the invention suggests that the body of a container made from an insulating material should be given a conductive outer coating at least in the area around the orifice thereinto, and indeed that preferably the entire base of the container should have such a conductive outer coating as well, in this case the two coatings being electrically connected in a suitable manner.

In one aspect, therefore, the invention provides a container formed of an insulating material and having an orifice in part of its surface, which container has a conductive coating at least in the area around and contiguous with the orifice, there being means permitting the electrical connection of the coating to a suitable earth.

The container of this invention may be of any shape and size. For the transport of flammable liquids, however, it will most conveniently be a drum (an

elongate cylindrical container) of around 200 litres; the 210 litre (about 45 gallon) L-ring drum mentioned above is a typical example.

The container of this invention is made of some insulating material. Clearly, in principle, any such material suitable for making a container can be used, though the purpose of the container naturally restricts the choice somewhat. Thus, the material must be physically strong enough both to carry the proposed contents without deformation and to stand up to the rough handling it may get, and it must be chemically resistant to the action of the contents. Moreover, it must be relatively inexpensive, and easily formed into the container, or else the result will be unable to compete in price with a steel container. Taking all these points into consideration, the currently preferred material is a high density, high molecular weight polyethylene, such as that available from B.P. under the trade name Rigidex Code HM 5420EP.

The container may, of course, be made in any way appropriate to the material being employed. Polyethylene is a thermoplastic, and containers made therefrom are very conveniently formed by a blow moulding technique, in which a parison of hot plastic material is extruded into a mould, sealed at each end, and then inflated to expand into contact with, and take the shape of, the mould.

To be useful the container must obviously have an

orifice in its surface. Commonly, drum containers of the kind of interest have such an orifice in one end, which end is normally referred to as the top of the container. The orifice may be defined by an upstanding neck disposed adjacent the edge of the top, which neck may be threaded to receive a screw-threaded cap. In fact, many drum like containers including the L-ring container mentioned hereinbefore have two such orifices, each arranged adjacent the edge of the top, in a diametrically-opposed manner.

The coated area around the (or each) orifice should extend away from the orifice by a significant distance, in order to ensure that the area where static electricity might cause a spark to jump to, and ignite, the liquid is properly discharged. A typical distance would be around 15 cm (6 in) across, centered on the orifice - which by chance is roughly the size of a recess provided in an L-ring drum, around the orifice.

The conductive area of the surface is required to be contiguous with the orifice in order that, as liquid is transferred through the orifice, any charge generated at the orifice edge itself is likely to be safely lead away to earth via the surface. It may be desirable for the coating to extend into the orifice, and even into the container and over the inner surface, though this may make sealing the orifice a problem.

In the area around and contiguous with the orifice

the container body has an exterior electrically-conductive coating. This coating may be of any convenient substance (one that is conductive enough to be useful, and is tough enough to stand up to the sort of rough treatment the container is likely to suffer), applied in any suitable way. For instance, the coating might be a pre-formed metallized plastics film or metal foil, which could be bonded into the container surface during the container's formation or bonded to the surface after that. Alternatively, the coating might be a metal oxide coating of the sort often used to provide transparent conductive layers in semi-conductor devices and on printed circuit boards. A further possibility is to employ a carbon-filled polyethylene. Possibly, the coating could be a metal- or graphite-loaded paint, that is simply painted into place. Preferably, however, the coating is a metal, or metal alloy, advantageously with a fairly low melting point so as to be easy to apply, without damaging the container. Such a metal or alloy may be hot-melt sprayed onto the surface. A typical metal for this purpose is zinc, which melts at about 850^{o}C, and which can be hot-sprayed from wire stock using a standard metal sprayer.

Before applying the conductive coating it may be necessary or desirable to pre-treat the container surface in some way - in order, for example, to improve the adhesion of the coating to the surface. Naturally, the pre-treatment chosen must fit both the coating and

the container material. Thus, when applying a hot-sprayed zinc coating to a polyethylene container, it may be advantageous first to roughen the relevant area of the surface, for instance by mild sand-blasting.

In order that the coating may be connected electrically to earth, an earth lead may be attached to the coated surface, and to this end there may be provided in the relevant area an earthing tag. This may be formed in any convenient way, but is preferably made when the container itself is made. An alternative is to have the coating extend over a suitable lip or flange of the container, whereby an earthing lead may simply be clipped thereto. For example, in the case of an L-ring drum, the coating may extend over the L-ring, to which ring an earthing lead easily may be attached by means of a spring-loaded clip.

As so far described, the inventive container has a conductive area around the orifice. It may well be advantageous, however, to coat much more of the container than this - and in particular to coat the base of the container (that part usually at the opposite end to the orifice, and normally in contact with the ground), and to provide a connecting strip leading down the side from the or each orifice area to the base. In this way charge picked up during handling may have a better chance of leaking away to earth during storage, whilst, even if an earthing lead is not connected,

charge generated during transfer may still leak away to earth via the strip and base coatings, provided the container stands on a conducting surface.

An embodiment of the invention will now be described, though by way of illustration only, with reference to the accompanying diagrammatic drawings, in which:-

Figure 1 shows a perspective view from above and one side of a container of the invention; and

Figure 2 shows an outline vertical half-sectional view on the container of Figure 1.

The container shown in the Figures has a main tubular body 11, with a top 12 and a bottom 13. It is a blow-moulded L-ring container and is provided with top and bottom L-ring carrying beads 14, in a well-known manner. In the top surface 12 are two recesses 15, and upstanding from each is a screw-threaded neck 16 defining a respective orifice. The whole of each recess 15 has a metal coating (the hatched area), as does the whole of the base 13. Moreover, a metal strip coating 17 runs down the side of the container, and electrically connects the two coated areas, at the top and the bottom. In Figure 2 the external coating is shown in heavy lines.

An earthing lead can conveniently be clipped to either bead 14 so as to connect electrically to the coated areas, thereby earthing the container, and specifically earthing the area around the filling

orifices. Also, provided the container stands on an earthed conducting surface, electrical charge will be conducted away from the region of the orifices, so minimising the likelihood of charge build-up, which could otherwise increase the fire risk.

CLAIMS

1. A container formed of an insulating material and having an orifice through a part of its surface, which container has a conductive coating at least over an area of the container surface around and contiguous with the orifice, there being means permitting the electrical connection of the coating to a suitable earth.

2. A container according to claim 1, wherein the container is made from a high density, high molecular weight polyethylene.

3. A container according to claim 1 or claim 2, wherein the container is a cylindrical drum or is barrel-shaped.

4. A container according to claim 3, wherein the orifice is provided in an end face of the container, and the conductive coating extends at least over a part of the end face of the container.

5. A container according to claim 4, wherein at least a strip-like area of the side wall of the container is provided with a conductive coating, which area is electrically continuous with that coated area around the orifice.

6. A container according to claim 5, wherein the end of the container opposed to that including the orifice is provided with a conductive coating, electrically continuous with the coating on the side wall of the container.

7. A container according to any of the preceding claims, wherein the conductive coating is a pre-formed metallized plastics film or metal foil, bonded to the container surface during the manufacture of the container or bonded to the container surface subsequent to manufacture.

8. A container according to any of claims 1 to 6, wherein the conductive coating is a metal oxide coating or a carbon-filled plastics material bonded to or incorporated in the container surface during or subsequent to the manufacture thereof.

9. A container according to any of claims 1 to 6, wherein the conductive coating is one of a metal- or graphite-loaded paint applied subsequent to the manufacture of the container, or a metal or metal alloy applied by a hot-melt spraying process subsequent to the manufacture of the container.

10. A container according to claim 9, where the coating is of zinc, hot-melt sprayed on the container surface after the manufacture thereof.

11. A container according to any of the preceding claims, wherein the container is provided with an earthing tag to which an earth lead may be attached so as to connect with the coated surface.

12. A container according to any of claims 1 to 10, wherein the coated area extends over an upstanding lip of the container to permit the electrical connection of an earthing clip thereto.

13. A container substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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